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Ebert

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(54) **HANDHELD CONTROLLERS AND ARTIFICIAL-REALITY SYSTEMS**

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CPC ***G06F 3/0338*** (2013.01); ***G06F 3/011*** (2013.01); ***G06F 3/016*** (2013.01); ***G06T 19/006*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,905,001	A *	2/1990	Penner	G06F 3/014 340/407.1
2001/0043847	A1 *	11/2001	Kramer	G06F 3/014 414/5
2017/0031443	A1 *	2/2017	Nakamura	G10K 15/04
2018/0284896	A1 *	10/2018	Kearney	G06F 3/014
2019/0380802	A1 *	12/2019	Savall	G06F 3/0346
2020/0237467	A1 *	7/2020	Savall	G06F 3/017

FOREIGN PATENT DOCUMENTS

AU	2016102467	A4 *	7/2021	A61F 2/583

* cited by examiner

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(57) **ABSTRACT**

The disclosed handheld controllers may include at least one finger force-feedback mechanism. The finger force-feedback mechanism may include a rotational element positioned to have an axis of rotation that is located along a palm side of a finger of an intended user's hand when holding the handheld controller, a proximal linkage element positioned and configured to rotate with the intended user's finger about the major knuckle when the user squeezes the handheld controller, and a distal linkage element positioned and configured to rotate relative to the proximal linkage element with the intended user's finger about the second knuckle when the user squeezes the handheld controller. Various other handheld controllers, artificial-reality systems, and methods are also disclosed.

17 Claims, 21 Drawing Sheets